

## SERPULA AND CRUCIGERA (POLYCHAETA, SERPULIDAE) FROM THE RUSSIAN FAR-EASTERN SEAS

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### ABSTRACT

The genera *Crucigera* and *Serpula* are represented in the Russian Far-Eastern seas by 3 species: *Crucigera irregularis* Bush, 1905, *Crucigera zygophora* (Johnson, 1901) and *Serpula columbiana* Johnson, 1901. *C. irregularis* is recorded for the first time from the region. *Serpula vermicularis* Linnaeus, 1767 cited earlier by Russian investigators is in fact *S. columbiana*. Data on the ecology and distribution of these species in the Far-Eastern seas of Russia are given.

*Keywords:* *Serpula*, *Crucigera*, Serpulidae, Russian Far-Eastern seas.

### INTRODUCTION

All species of Russian *Serpula* and *Crucigera* are known only from the Far-Eastern region. Two species (*C. zygophora* (Johnson, 1901) and *S. vermicularis* Linnaeus, 1767) have been documented from the Russian seas to date, however these data are not complete and partially erroneous. The present paper deals with the revision of species of the genera *Serpula* and *Crucigera* from the seas of Russia.

Since there are rather few records of these serpulids in Russian literature, we have tried to include and to comment on all existing data, not only from the well-known faunistic papers, but also information which usually is not considered in such studies (i.e., compilation of faunal lists, species lists on biocenosis). The papers cited in the synonymy without reexamination of material are marked by an asterisk (\*). As a rule, this material has not been preserved or was difficult to access.

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## MATERIAL AND METHODS

The material identified earlier by Russian specialists (I. G. Zachs, N. P. Annenkova, K. A. Vinogradov, P. V. Uschakov, G. N. Buzhinskaja, V. V. Chlebovitsch and T. F. Tarakanova) was reexamined. These specimens are kept in the collections of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg (ZI) and the Institute of Marine Biology of the Far East Branch of the Russian Academy of Sciences, Vladivostok (IMB). We also examined previously unstudied collections of the ZI, the Institute of Oceanology of the Russian Academy of Sciences, Moscow (IO) and the Laboratory of Marine and Island Communities of the IMB. In addition, we studied new material, collected by the Laboratory of Benthic Communities of the Kamchatka Institute of Ecology and Environment of the Far East Branch of the Russian Academy of Sciences, Petropavlovsk-Kamchatsky (KIEE) during expeditions to the coasts of Eastern Kamchatka, Commander Islands and Northern Kurile Islands between 1982-1988.

The 28 samples of *S. vermicularis* (114 specimens) from the Norwegian Sea, deposited in the collection of the Hydrobiology Department of the Moscow State University (HD), were also examined.

## RESULTS AND DISCUSSION

*Serpula* Linnaeus, 1758

*Serpula columbiana* Johnson, 1901

*Serpula columbiana*: \* Johnson 1901: 432-433; Zachs 1933: 135; Annenkova 1937: 197; Annenkova 1938: 216-217; Uschakov 1950: 230; Uschakov 1953: 163.

*Serpula splendens*: \* Bush 1905: 230-232, pl. 26 fig. 3, pl. 29 fig. 2, pl. 30 fig. 2, 3, pl. 33 fig. 31, pl. 35 fig. 18, pl. 37 fig. 31, pl. 39 fig. 33.

*Serpula vermicularis* (non Linnaeus, 1767): \* Hartman 1948: 47; Uschakov 1955: 424, fig. 160 A-D; Uschakov 1959: 208; Chlebovitsch 1961: 232-233; Buzhinskaja 1967: 118-119; Buzhinskaja 1971: 309; Tarakanova 1974 b: 354 (citation of Chlebovitsch 1961); Kussakin 1975: 62 (citation of Chlebovitsch 1961); \* Buzhinskaja in Pogrebov & Kashenko 1976: 71, 72; \* Bagaveeva in Pogrebov 1979: 72; \* Volova et al. 1980: 42; Buzhinskaja 1985: 193; Sirenko et al. 1988: 47.

*Material examined*: 120 specimens from 74 samples.

*Remarks*. *S. columbiana* was described originally from the Californian coast. It is widespread in the Asian and American waters of the North Pacific. Hartman (1948) placed this name in the synonymy of *S. vermicularis*, which was described from the temperate waters of Western Europe and is considered to be cosmopolitan by many authors (Day 1967, Straughan 1967, Uchida 1978, Vine & Bailey-

Table 1. Distinctive characters of *Serpula columbiana* and *S. vermicularis*.

Characters	<i>S. columbiana</i>	<i>S. vermicularis</i>
1. Operculum		
a. number of opercular radii *	(62)84-105.8-136 SD = 13.3; n = 29	(35)38-52.5-82 SD = 8.9; n = 39
b. Opercular form (Fig. 1)	deep funnel	funnel with slightly concave distal surface
2. Maximum length of body	120 mm	60 mm
3. Tube		
a. Diameter	15 mm	6 mm
b. Colour	greyish	pinkish
c. Peristomes	absent	present
d. Longitudinal ridges	absent	present
e. Ring-shaped bulges	present	absent

\*The standard method of serpulid description (Hove & Jansen-Jacobs 1984) was used to determine number of opercular radii: (min.number of opercular radii) min.number used for calculation - mean - max.number of opercular radii; n = number of specimens.

-Brock 1984). Uschakov (1955) and later all Russian scientists followed this synonymy.

Until now no attempt has been made to compare a series of specimens of *Serpula* from the North Pacific with such from the North Atlantic, although Hove & Jansen-Jacobs (1984: 150) considered both *S. columbiana* and *S. vermicularis* to be valid species. Our comparison shows that all worms from the Russian Far-Eastern seas labelled »*Serpula vermicularis*« (ZI and IMB collections) differ obviously from *S. vermicularis* s. str. (our material from the Norwegian Sea) by external morphological characters, and agree with the original description of *S. columbiana* Johnson, 1901. Both species can easily be distinguished using the features given in Table 1.

Since *S. vermicularis* was not found in our extensive material, we suppose that this species is absent in the North-Western Pacific. Most of the non-reexamined records of the nominal species *S. vermicularis* from the Far-Eastern seas of Russia are, most probably, referable to as *S. columbiana*.

However, we have grave doubts concerning records of »*S. vermicularis*« from the intertidal zone of the Commander Islands (Bering Island) and East Kamchatka shores. The first record from the Commander Islands was by Uschakov (1955), based on unpublished data of Annenkova. Later this material was also cited by Levenshtein (1966). Unfortunately, Annenkova's material is represented now by a single specimen (ZI collection) which is in poor condition (without tube and operculum) and unfit for identification.

In the material of Tarakanova (1978b), collected in 1972 from the intertidal zone of Bering Island, a single well-preserved specimen of *S. columbiana* (labelled »*Crucigera zygophora*«) was found. Since *S. columbiana* was absent in our extensive material from the Commander Islands, and the species would not easily be mistaken for *C. zygophora*, we suppose that an error in labelling occurred. Conse-

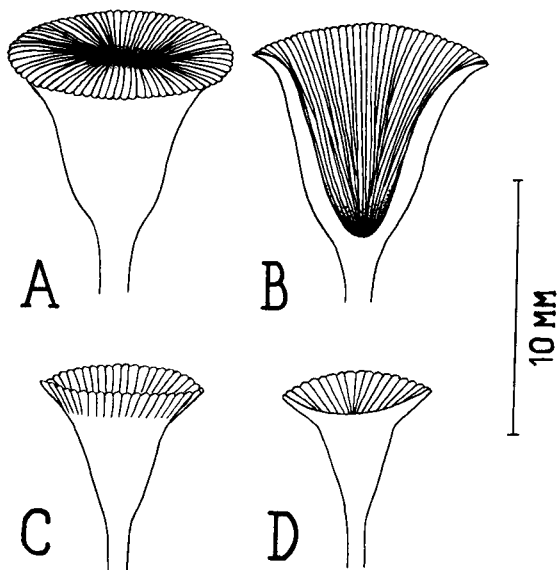


Fig. 1. Operculum of *Serpula columbiana* - A and B (in section); Operculum of *S. vermicularis* - C and D (in section).

quently we have not included these data in the synonymy list and the distribution map.

Similarly, Vinogradov (1946) recorded *S. columbiana* in Avacha Bay (East Kamchatka) and Uschakov (1955) used these data when defining the distribution of this species (as *S. vermicularis*) in the Russian seas. Unfortunately, the material was lost, but the record is doubtful for the reasons mentioned above.

According to the original description (Bush 1905), *Serpula splendens* differs from *S. columbiana* only in having more numerous branchiae and fewer serrations on the margin of the operculum. In our opinion, and in view of the variability of characters, these differences are insufficient for a distinction on species level and *S. splendens* was correctly placed in the synonymy of *S. columbiana* by Pixell (1912), as in the opinion of Hove & Jansen-Jacobs (1984).

**Ecology.** The worms occur at depths from 2-3 to 200 m on stony substrata (large pebbles, horizontal surface of boulders and rocks) and on sandy bottoms with an admixture of stones and shells which provide a solid substratum. In the latter case, tubes of worms usually form large aggregations. *S. columbiana* is also common in oyster and mussel banks.

**Distribution in Russian seas.** Sea of Japan (Possieta Gulf, Petra Velikogo Gulf, Olga Bay, northern part of Primorsky Krai, Tataric Strait near Nelma), Moneron Island, Sakhalin Island (Aniva Bay, south-west coast from Laperusa Strait to Chehov), Southern Kurile Islands (Kunashir, Shikotan, Iturup) (Fig. 2).

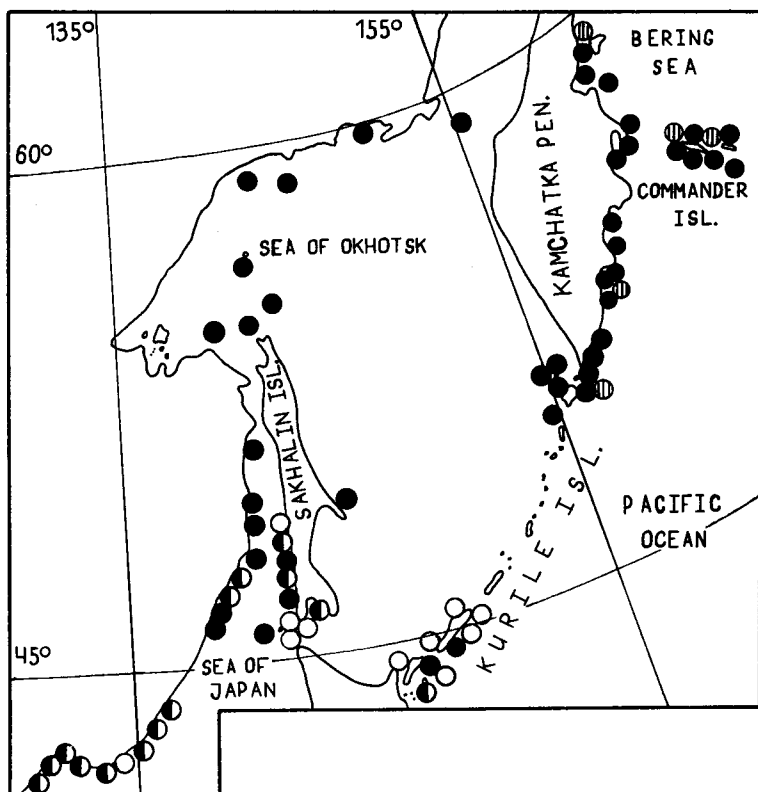


Fig. 2. The distribution of *Serpula* and *Crucigera* in Russian seas. ○ - *S. columbiana*; ● - *C. zygophora*; ⊖ - *C. irregularis*.

#### *Crucigera* Benedict, 1887

A thorough revision of the genus was recently undertaken (Hove & Jansen-Jacobs 1984). However, the authors had no material from the Russian seas, so that the distribution of *C. zygophora* in this region was derived from literature only (Annenkova 1937, Vinogradov 1948, Uschakov 1955, Kussakin 1975).

According to our data, the small genus *Crucigera* (containing 5 species) is represented in Russian seas by two species only.

#### *Crucigera irregularis* Bush, 1905

*Crucigera irregularis*: \*Hove & Jansen-Jacobs 1984: 170-176, fig. 3b, 4f, g, 5c, 8e, f, 9k-o, 10b, 11j-o, 12 (synonymy).

*Material examined*: 14 specimens from 7 samples.

*Remarks*. It is the first record from the Russian seas.

*Ecology.* Worms were found at depths from 19 to 176 m. Tubes were attached to large stones and shells of large bivalves.

*Distribution in Russian seas.* Bering Sea (Litke Strait); Eastern Kamchatka (Avacha Bay): 52°54,5'N, 160°01,2'E; 52°54,5'N, 160°03,0'E; 52°53,6'N, 160°09,5'E; Northern Kurile Islands: 49°38,6'N, 156°23,5'E; Commander Islands: 55°22,0'N, 165°08,0'E; 55°22,4'N, 165°33,0'E.

*Crucigera zygophora* (Johnson, 1901)

*Crucigera zygophora:* Zachs 1933: 135, \* Imajima 1963: 368; Tarakanova 1978a: 93; Tarakanova 1978b: 161 (partim?); \*Hove & Jansen-Jacobs 1984: 164-170, fig. 4a-c, 5d, 8d, 9a-j, 10a, c, d, 11a-k, 12 (synonymy); Buzhinskaja 1985: 193; Sirenko et al. 1988: 47; Rzhavsky 1989: 104; Rzhavsky & Solochina 1989: 41.

*Serpula zygophora:* Annenkova 1934: 322; Annenkova 1937: 197; Uschakov 1950: 230; Uschakov 1953: 103; Uschakov 1959: 208; Tarakanova 1974a: 125; Tarakanova 1974b: 354; Kussakin 1975: 62 (citation of Tarakanova 1974a; \* Buzhinskaja in Pogrebov & Kashenko 1976: 72; \* Bagaveeva in Pogrebov 1979: 72.

*Serpula (Crucigera) zygophora:* Annenkova 1938: 216-217; Vinogradov 1946: 742; Vinogradov 1948: 1274-1275; Uschakov 1955: 425, fig. 160 E; \* Chlebovitsch, Levenshtein in Kuznetsov 1963: 71, 255, 260; \* Levenshtein 1966: 77.

*Material examined:* about 1000 specimens from more than 200 samples.

*Remarks.* Data based on material not reexamined are probably correct as *C. zygophora* differs clearly from all other species found in the mentioned areas and, therefore, we have included these in the distribution map. Some perplexity was caused by the presence of *S. columbiana* specimens in material from the intertidal zone of Bering Island (Commander Islands) identified by Tarakanova (1978b). A possible explanation for this occurrence was discussed above.

*Ecology.* Worms attach to stones, rocks and shells of gastropods and bivalves. Sometimes this species can be referred to the epifauna of soft substrata, when small stones, gravel and shells are used as initial settling sites. In this case large aggregations, lying on the surface of dense, soft substrata, are formed.

Worms were found from the mid-intertidal zone to 560 m (usually to about 100 m) depth.

*Distribution in Russian seas.* Sea of Japan (Possieta Gulf, Petra Velikogo Gulf, the northern part of Primorsky Krai and Tataric Strait from Olga Bay to Shelikov (= de Kastri) Bay); Moneron Island; Sakhalin Island (Aniva Bay, Terpenia Peninsula, south-west coast from Holmsk to Chehov); Kurile Islands (Kunashir, Shikotan, Iturup, Paramushir, Shumshu, Atlasov); Sea of Okhotsk (from Alevin Cape

to Shelichov Bay); Pacific coast of Kamchatka from Cape Lopatka to Cape Afri-  
ca; Commander Islands (Bering, Medny (= Cooper), Toporkov); Bering Sea  
(Karaginsky Bay) (Fig. 2).

Unfortunately, we were unable to identify and plot on the distribution map  
Kuznetsov's (1963) records of *C. zygophora* near Northern Kurile Islands and  
Eastern Kamchatka.

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